The Interest of European Scientists in Indian Calendar and Chronology

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Introduction:

At the outset, the topic may appears to be strange, but it is fact that the European scientists of 16th to 19th centuries had taken much interest in Indian chronology, Cosmology, astronomy, mathematics and other sciences, as they were struggling to tackle the Longitude problem thereby to construct a systematic calendar. Indian system of time reckoning, recording and keeping had been the main subject of discussion and research among the European scientists, mathematicians and scholars. Their attempts to discover the origin and antiquity of man, his achievements in arts and science had also favoured India and thus attention turned towards India[1]. The Indian chronological influence on other countries had been also an important topic among them. Oskar von Hinuber has pointed out as to how India had influenced the chronology of other countries[2] like Tibet, Thailand, Indonesia, Burma, Sri Lanka.

In fact, the Indian chronology of great antiquity was the cause for controversy among many leading scientists. Many times, it had affected their scientific temper and started acrimonious accusations and mudslinging made against each other. Thus, Newton was fighting with Robert Locke and Gottfried Wilhelm Leibniz; John Bentley with John Playfair and Colebrook; and so on. Thus, the casualty had / has been the Indian historiography and chronology. The divided scholars have left their works with the divided opinions and interpretations, which are taken by the succeeding scholars with the in built bias and prejudice.

It has to be mentioned that most of the leading scientists like Newton were practicing astrology and astronomy using it for the construction of chronology. As the Christian missionaries visiting India were supplying enough manuscripts, palm leaves, charts and other materials of India to them, research was going on in London, Berlin, Paris, Lisbon and so on. Findings and reports were published in mainly in English, German, French, and Portuguese. Later, they were widely discussed among themselves. Of course, the Church intervened many times controlling their activities.

Chronology – Its relation to Astronomy and Astrology:

It is said that the system of reckoning time and hence that of historical events has been a modern concept, but it is modern even among the westerners. Different westerners or Europeans were using different systems of time reckoning in their respective countries based on the prevalent culture, tradition and heritage.

विज्ञान भारती, झारखण्ड

Pope Gregory XIII (1572-1585), who decreed in 1582 a calendar with fasts and feasts to be adopted by the Roman Catholics, heavily depended on the Indian astronomical tables. It contained many inaccuracies:

1. The year 1582 had only 355 days.
2. The concept of leap year. 1600 was made leap year, but not 1700,1800,1900, 2100, 2200, 2300 and so on.
3. There was no leap year between 1896 and 1904, and 1900 was not considered as a leap year.
4. Ten days were dropped and 5th October 1582 was called 15th October.
5. The error accumulation is one day in about 3,320 years.

Though, the Greek Church and Protestant nations did not recognize and follow it, in 1752, England fall in line by calling 3rd September as 14th! The year was made commence on January 1st instead of March 25th! In fact, the chronologization of events based on the new calendar has created many problems. They started mentioning the dates followed by O.S (Old System) and N.S (New System). For example, the date of birth of Newton himself was subjected to dispute – Dec.25, 1642 O.S or January 4, 1643 N.S!

Here, the Church played a crucial role in imposing Gregorian Calendar (1582) on the Christian States to be followed for political and civil purposes. Then came James Ussher (1581-1656), the famous Christian chronologer. He went to England in 1640 and took part in the ecclesiastical questions raised in the ***Long Parliament***. He was the first to attempt the Biblical chronology and declared that the God, Jehovah created the Universe and the world on October 23, 4004 BCE at 9.30 A.M.! All the Church and other historians faithfully followed his works ***Britannicarum Ecclesiarum Antiquitates*** (1639) and ***The Annals of the World*** (1658). Accordingly, almanacs, annals erc., were compiled with the new Calendar. The Christian scholars, historians or scientists had strong belief that the Ussher's system should be adhered strictly. The essentials of the bibliocal version of creation and the world's history was not seriously questioned during the 18th century[2A].

An ***almanac*** is a year book of dates and tables, giving a calendar of days and months, ecclesiastical fasts and feasts, the age of the moon, the tides, and the exact time of sun's rising and setting etc. The name almanac is derived from ***al-manah*** in Arabic, as the Europeans obtained such tables from the Arabs, but the Arabs, in fact got them from Indians. Al manah means the sundial, because, all the measurements of time were made principally associated with the Sun. This is nothing but ***panchangam*** used in India since time immemorial (the extant work ***Vedanga Jyotisa*** of Lagada c.1400 BCE). According to the claim of westerners, ***Regiomontanus*** published the fist almanac in Latin in 1475.

Longitude Problem:

Longitude is the imaginary line fixed on the surface of the earth with reference to some fixed point so that location and time of another point can be determined with reference to the fixed point. In India, the astronomical observations were based on asterism and time was kept based on it. They had already fixed their meridian at Ujjaini and calculations made. The work ***Surya Siddhanta***, the ancient extant astronomical work specifically mention about the longitude to locate places and compute time. The later

works *Aryabhatiyam, Laghu Bhaskariya, Maha Bhaskariya* etc., elaborately dealt with methods determination of local latitude and longitude using observations of solar declination, or polar star, and simple instruments like the gnomon, and the clepsydra.

Many famous sailors undertook expedition to find sea route to India, but failed. Many lives lost, ships wrecked and money squandered. Even Columbus ended with landing on some land and declaring that he reached India! Now, it is well known that Vasco da Gama reached India as per the directions of an Indian sailor. Therefore, the Europeans were eager to know the methods used by the Indians. Thus, the Christian priests - Jesuits were sent specifically for the purpose.

In Oxford, from 1645 onwards, the longitude problem was the main topic of discussion. It was connected with stellar navigation. Almost all scientists took interest in this problem, because of the huge prize money offered by the Spanish (1567, 1598), the Dutch (1632), the French (1670), and the British (1711) governments for anyone who could provide an accurate technique of navigation. Galileo Galeli unsuccessfully competed for the Spanish prize for 16 years, then shifted his attention to the Dutch prize. Colbert wrote personally to all the leading scientists of Europe offering large awards and selected from the replies received to start the French Royal Academy to improve maps, sailing charts and advance of science of navigation.

Nautical almanac is a volume of tables and calculations for the use of navigators and astronomers, first issued only in 1769, but, such tables were available already in India. That is why the European scientists and astronomers were astonished to find ready made tables prevalent far away from their lands.

European Universities Researching on Indian Arts and Sciences:

At the outset, it is pointed out that the concept of University is a misnomer in medieval and European context, as Universities were not founded, but grew out of the nature of things and association of men attached to cathedrals and abbeys. However, there were well-established schools or learning centres in eastern countries – India, Central Asian countries and Middle East. All Hindu, Buddhist monasteries and later Muslim madrasas functioned as Universities. But, according to European claim, at the end of 12th century, there were only three prominent universities in Europe –

1. Paris (Theology),
2. Bologna (Law),
3. Salerno (Medicine).

However, there were other Universities where many reputed scientists studied, where the Brahmagupta's Siddhanta and Indian tables reached already through Moors/Muslims. They were known as ***Zij***, reportedly derived from Siddhanta, the Indian astroinomical work - ***Siddhanta – Sindhind – Zij***. The Indian numerals were known as ***Ar ruqum al Hindiyeh***. Alkhwarazmi of Khiwa's work is known as ***Sindhind as saghir*** (minor Sinhind or minor Siddhantas to distinguish from the major Siddhanta of Brahmagupta). Thus, there are hundreds of Zijs – Zij-I sultani of Uleg Beg, Zij-I Khaqani of Ghiyath al-Din-Kashi and so on.

Under the patronage of Alphonso X (1226-84) of Castile, the famous fifty astronomers at Toledo improved and compiled astronomical tables in 1252. They are known as Alphonso tables and first printed in 1483. They are – Padua (a town, capital of Padova, Italy), Toledo (a city near Madrid, Spain – University established in 1222, became famous in 13th century), Bologna, Oxford (c.1167?), Paris (c.1140 or 1170?), Berlin were famous for researching India with Indian manuscripts. As Buddhist (from China) and Muslim (from Middle East) scholars came to India to collect manuscripts, scrolls, palm leaves and other documents on Arts and Sciences, the Christian missionaries (from Europe) followed the suit. The Indian works were translated into Arabic and then to Italian. From Italian, they were translated into European languages – Portuguese, French, German, English and so on reaching the European scientists.

European Research on Indian Astronomical Tables:

The Tiruvalore astronomical tables (of 1687) created a great storm among the astronomers, mathematicians and scientists. The tables start with an epoch during the conjunction of planets occurred in 3102 BCE, which is nothing but the starting of Kali age according to Hindu astronomers and chronologers. The astronomical manuscripts mainly contain the following -

1. Tables and rules for calculating the places of the sun and moon.
2. Tables and rules for calculating the places of the planets.
3. Rules by which the planets of eclipses are determined.

All astronomical calculations and Puranic-based computation of events had been according to Kali era in India. As such computation went beyond Mosaic flood, the Christian scholars and scientists spent much time to ascertain the authenticity and accuracy of such reckoning. As more and more astronomers, mathematicians and scientists started accepting the authenticity of the era, another parallel group initiated counter arguements. Thus, Cassini, Baily, John Playfair, Colebrook and others supported it, while, Newton, Joseph Priestley, John Bentley and others opposed it all in the name of science. The marathon debate occurred on the Kali era has not died down even today[3].

Now, the scientists who have involved in the study of Indian chronology, mathematical and astronomical tables and works are considered.

Nicolas Copernicus (1473-1543):

Studied medicine at Padua, Italy, but started researching in the movement of planets. First, he started studying at Cracow, Poland and then moved to Italian Universities – Bolgona, Ferrara and Padea. The study of medicine was, in those, closely allied to the study of astronomy, ***as the mystic connection between the organs of body and the signs of zodiac was thoroughly expounded. According to the movement of planets through zodiac, the fortunes and thus the health of men was predicted.*** In Frauenberg, Poland, he started taking the astronomical measurements, which had come down to him the Greeks, the Arabs and ***the Indians***. Theological and philosophical ideas were always mixed with science to propound astronomical theories[4]. Aryabhatiyam was translated in 13th century in Italian and it was read by the scholars of the material period.

Along with Indian works, the tables were also available to them. He propounded the Heliocentric theory inviting the wrath of the Church. His work had been on the Index of prohibited books by the Roman Catholic Church, as being subversive of truth between 1616 and 1757. His observations and recordings were not accurate.

Giardano Bruno (1548-1600):

Born at Nola near Naples, Italy became a Dominican preaching friar at the age of 15. Because of his philosophical, theological and mystical ideas, he was made to flee from Italy to France, England, Germany and Switzerland. His works, "On the Infinite Universe and Its Worlds" (1583) and "On the Triumph of the .....", he discusses about the great cosmos with many worlds carrying astronomy beyond solar system. According to him, ***the Universe is infinite, there are other infinite worlds and Suns*****.....**He explicitly said that both the creator and his creation are one and the same or identical. His book ***De Magnette*** published by William Gilbert (1540/1544/1546 to 1603) described the scheme of Universe / cosmos as propounded by him, which tallies with that of Indians. In 1593, when he returned to Italy, he was jailed under inquisition. He was ordered to be punished, "***with all possible clemency, and without shed of blood***". The Church burned him to death at stake because of his Helio centric theory and propagation about Transubstantiation, Consubstantiation and Immaculate Conception.

Tycho Brahe (1546-1601):

His planetary model resembles that of Nilakanta Somasutvan (1444-1550) and hence, it has been suggested that the Indian model might have been adapted and adopted by Tyhcho Brahe[5]. His student was Johannes Kepler. The planetary motion is connected with the measurement time.

Matteo Ricco (1552-1610):

He was the first batch of Jesuits trained in the new mathematics curriculum introduced in the Collegio Romano by Christopher Clavius. The Italian Missionary was sent to China, who came to Goa, India in 1577. From there, he proceeded to China. Again, after his work in China from 1583 to 1610, he came to Goa in 1611 and stayed there for four years in India. In his first visit, he lived in Goa and then in Cochin from September 13, 1578 to April 15, 1582 meeting Brahmins and Moors to learn recording and measuring time and collect manuscripts[6]. He specifically made enquiries about Indian calendar and collected connected manuscripts. He took many manuscripts on return.

Galelio Galeli (1564-1642):

Italian scientist and Professor of mathematics at Paduva University, after his dismissal from Pisa in 1591. There, he started his interest in astronomy. The Paduva's connection with Indian astronomy has already been mentioned. He attempted maximum in getting the Spanish prize to solve the Latitude problem, but could not do so. After spending 16 years, his turned his attention to Dutch prize. He heavily borrowed scientific

ideas from the Jesuit sources[7]. The Jesuit connection with Indian sciences has been mentioned.

Johannes Kepler (1571-1630):

He studied the Kaliyuga and reckoning of the Hindus, but accused that Hindus borrowed from the Christians and the Jews from the Chaldeans, who, it is claimed that Messiah would appear in the Lunar year of the world 4320! Nilakanta's planetary model is exactly the Tychonic model (Tycho was a contemporary of Christopher Clavius), except that it involves eliptical orbits Tycho Brahe's student was Johannes Kepler, who obtained his elliptical orbits by computing his (Tycho's) observations. In 1990, it was pointed out that Kepler fabricated his data to obtain the planetary motion[9]. If the data could be obtained scientifically by working based on observations or derived formulae, one need not cook up figures, because, the figures are mathematical, which could be verified by any body to find out the facts contained. Therefore, scientist like Kepler could not have changed his figures, unless, he got hold of some other figures, which would have appealed to him the most. As he was having only the final figures and not the working to arrive at such figures, he would have arrived at some figures without giving the source or working. Therefore, such changed figures are perhaps now mentioned as "fabricated".

Pope Gregory XIII (1572-1585)[10]:

He was the reformer of the Julian calendar and it was later known as the Gregorian calendar, decreed in 1582 a calendar with fasts and feasts to be adopted by the Roman Catholics, heavily depended on the Indian astronomical tables. To reform the calendar, he constituted a commission, which included astronomers like Italian physicist Lilio[11], who had been familiar with Indian calendar and time reckoning and headed by Christoph Clavius. It is evident that he must have procured Indian methods of construction of calendar. He was to complete another great work, closely allied to the reform of calendar – the publication of the Roman Martyrology. The Saints whose feasts had to be celebrated only in certain places were inserted in of the Roman Martyrology.

Robert de Nobili (1577-1656):

The Roman Catholic priest came to Madurai in 1606 was best known for his donning of saffron robe and calling himself as a Sanyasi. He claimed that he recovered the lost fifth veda by the Brahmins and circulated it as ***Yasur Veda***, by fabricating manuscripts, but the Protestants exposed his trick. Though the scholars usually mention these details, they have not mentioned his interest in Indian astrology and astronomy. He was specifically sent to Madurai with particular instructions from Rome after studies and ordination at Vatican (1600-03) and Lisbon (1603-05). Reaching Goa (1605-06), he proceeded to Madurai with information. He came from the family of Pope Julius III and Gregory XIII (1572-1585), who introduced the Gregorian calendar. He had collaborated with Matteo Ricci (who was ion Goa 1611-1615) in Indianizing Christianity.

Sivadarma a Telugu Brahmin taught him Sanskrit from 1608 to 1609. With his help, particularly, after his conversion in 1609, many manuscripts were collected.

Sivadarma evidently copied other manuscripts and gave to Nobili, which were circulated as Yasur Vedam. Thus, both had indulged in collecting, copying Indian manuscripts. Later some of these had reached the hands of Voltaire also. He collected astronomical works and tables of Tamilnadu and studied the calendar making method adopted by the South Indians. At one side he criticised the Vedanga Jyotisa[12], whereas on the other side, he was collecting all such astronomical works and tables. He also compiled a Tamil book explaining the methods applicable to Church in observance of feasts and fasts of saints. After his death on January 16, 1656, his important Indian collections were sent to Rome.

Simon de La Loubere (1642-1729):

He brought an extract of a Siamese manuscript containing tables and rules for calculating the places of Sun and moon (Mem de l'Acad. Des Science, tom.8, p.281 & c). Inspired by this, the European scientists started their research in the tables.

Sir Issac Newton (1642-1727):

In his ***Chronology of Ancient Kingdoms Amended*** (posthumously published in 1728) insisted that no civilization be earlier than the Jewish one. He did not accept any civilization's chronology that went beyond the Flood. Thus, he rejected the Kali era starting with 3102 BCE. He was a staunch believer and interested in the ancient astrology, mythology, cosmology, Church history, Biblical prophecies, etc. According to him, ***"Ancient mythology was nothing but historical truth in a poetical dress"***. Because of his extreme views about Christianity, P. J. Marshal characteristically mentions him as ***the more intrepid Christian***[13]. According to John Locke (1632-1704), Newton had few equals in Biblical knowledge.

He was an ardent follower of traditional astrology and astronomy. He tried to bring new precision in chronological discussions by using astronomical calculations. He interpreted that Chiron the Centaur was said to have been the first to delineate the constellations and to help the Argonauts to make a sphere by which to navigate. Newton[14] tried to date the Argonauts' expedition by comparing the equinoctual colure on Chiron's constellation with his own observations for 1689. He believed that the mention of the zodiac could be traced back to this event. He propounded that the practice of observing stars began in Egypt and Greeks derived from them. But, William Jones discounted his theory and he had gone to the extent that Newton had been influenced by the Indian thought[15]. Robert Burrow showed that Hindus knew binomial theorem before Newton asserting that while Newton was responsible for application of the binomial theorem to fractional indices, the Hindus understood it in whole numbers to the full as well as Briggs, and much better than Pascal[16]. B. N. seal[16A] pointed out as to how Newton could have derived his Calculus from Bhaskara (c.1114-1150). He also refuted the argument of Spottiswoode. In his research on Hebrew scriptures, he found that they had been tampered with and remodelled, had been lost and rewritten, a dozen times before the days of Ezra[17]. He testified before the British parliament in connection with the longitude problem of navigation. He was corresponding with Wallis in 1692 and Leibniz in 1693, Bentley about these topics.

Gottfried Wilhelm Leibniz (1646-1716):

He developed Calculus independently. However, Newton had also been credited with the invention of Calculus. As he first published his paper in 1684 on Differential calculus, it was made public. Newton too discovered similar method as early as 1665, but published only in 1693. This made Newton furious and thereafter, he took every opportunity to attack Leibiniz in his writings. Incidentally, this controversy exposes the Indian methodology of Calculus reaching Europe. Some British scholars accused that Leibniz plagiarized Calculus methods from Newton, whereas others accuse that both derived it from the Indian sources, as the subject could not have evolved all of sudden without the rigorous discussion on infinite series and infinitesimals[18]. In 1710, Leibniz in a dissertation in Miscellanea Berolinensia, tried to construct a comprehensive system of linguistic geneology, assuming that the languages of Europe and Asia and as well as of Egypt were descended from the same orioginal language[19]. Later, William Jones pointed out the weaker argument in his article. His father was a friend of Newton, Samuel Johnson and Lord Parker, the President of the Royal Society.

Nicolas Louis De La Caille (1713-62):

French astronomer who first determined the length of an arc of the meridian accurately. He too took interest in the Indian tables. In the attempts to determine the length of the year based on the Indian tables, it was found to be equal to 365d. 6h. 12'. 36, which is greater than that of De La Caille i.e, 365d. 5h. 50'. 41". The difference is 1' 53"

Leonard Euler (1707-1783):

A Swiss mathematician, who took interest in Hindu astronomy and calendar. He was also an occultist studying on mysteries of the world comparing with science. He[20] wrote on the "Hindu Year" of 365d 6h 12m 30s T. S. Bayer, in an appendix to his history of imperial Graceo-Bactarians, furnished some information about Hindu astronomy. He recorded the important note of Euler on the length of the Hindu year.

Le Gentil de La Galaisiere (1725-1792):

A French astronomer. He studied the Indian tables in detail and also spent some time on the Coromandel Coast studying Indian techniques at first hand from the Indian astronomers and scholars. He[21] had been there to observe the transit of Venus in 1769. During his stay at Tirvalore, he learned the methods from a Brahmin, which he used for calculating eclipses of the Sun and moon, and communicated to him the tables and rules, that were published in the Memoirs of the Academy of Sciences, for 1772.

Nevil Meskelyne (1732-1811):

Astronomer Royal, who collaborated with John Bentley in interpreting the Indian astronomical tables. He opined about the Bentley's workings as follows[22]:

> "*I think Bentley right: he has proved by his calculations that there were no real observations made at the beginning of the Kali Yuga. Bailly was a pleasing historical writer; but he had more imagination than judgment, and I know that he was condemned by his friends La Lande and La Place, as a superficial astronomer, and a very indifferent calculator. These two gentlemen entertained the same opinion with myself, with respect to the antiquity of Hindu astronomy; and I think Mr. Bentley has made out satisfactorily the real antiquity of the Surya Siddhanta*".

This also proves that the European astronomers and scientists were discussing about and working together on the Indian tables and chronology.

Joseph Priestley (1733-1804):

The greatest scientist of the late 18th century, an English chemist inventor of gases including Oxygen was a minister in different chapels. In 1791, because of his advanced political views, his house and chapel were burned by a mob and he was compelled to move to London first, then to America. Surprisingly, the scientist who was experimenting with the gases, came to the defense of Moses[23], as Newton had done at the beginning of the 18th century. He used Jones dating in his defense of Moses (pp.7-15). He had low opinion of Hinduism and thought comparisons between the Old Testament and Hindu scripture provided strongest possible argument for the divine inspiration of Moses. In his opinion, the general character of the devotion of the Hindoos is that of a debasing superstition (Ibid, pp.6-7). He upheld that the antiquity of Christianity as against Hinduism[24].

T. S. Bayer :

Early in the 18th century, he furnished information about the Hindu asterism, such as the Sanskrit and Tamil names of planets, days of week, months and twelve signs of the Zodiac[25].

John Playfair (1748-1819):

He was Scottish geologist and mathematician at Edinburgh University. He read a paper ***Remarks on the Astronomy of Brahmins*** on March 2, 1789. Mathematically, he proves that the calculation starting with 3102 BCE is correct. In 1797, he published another ***paper Observations on the Trigonometrical Tables of the Brahmins***. Based on the confirmations of Bailly, Cassini and De La Place, he enumerated the following astronomical elements, to which the Indian tables and modern tables agree each other:

Sl. No	Astronomical factor under consideration	Indian value	Modern / western value	Difference *
1	The inequality of the precession of the equinoxes.	54"	54"	NIL
2	The acceleration of the moon	5" 43' 7"	5" 44' 14"	1' 7"
3	The length of the syderial year	365^d 6^h 12' 30"	365^d 5^h 50' 35"	1' 46"
4	The length of the solar year	365^d 5^h 50' 45"	365^d 5^h 50' 45"	NIL
5	The mean place of the sun	10^s 3° 38' 13"	10^s 2° 51' 19"	47"
6	The mean place of the moon	10^s 6° 37' 0" KE 10^s 6° 0' 0" TT	10^s 0° 51' 16"	5° 45' 44"
7	The equation of the sun's centre.	2° 8' 14"	2° 8' 16"	2'
8	The obliquity of the eclecptic.	23° 51' 13"	23° 57' 45"	
9	The place of Jupiter's aphelion	3^s 27^0 0'	3^s 16^0 48' 58" 3^s 26^0 50' 40"	10^0 10' 40"
10	The equation of Saturn's centre	7^0 39' 44"	7^0 41' 22"	less 1' 38"
11	The inequalities in the mean motion of Jupiter.	30^0 20' 42"	30^0 20' 42"	NIL
12	The inequalities in the mean motion of Saturn.	12^0 13' 13"	12^0 13' 14"	less 1"

John Bentley acrimoniously attacked him, for his criticism against his writings supposedly appeared in Edinburgh Review. He was professor of Mathematics there, but exchanged to the Natural philosophy chair in 1802, probably, as he had been against the interests of the then European scholars.

Pierre Simon Marquis De Laplace (1749-1829):

French mathematician. In seeking for the cause of the secular equations, which modern astronomers have found it necessary to apply to the mean motion of Jupiter and Saturn. M. De La Place has discovered that there are inequalities from their mutual action on another, which have long periods, one of them no less than 877 years, so that the mean motion must appear different, if it be determined from observations made in different parts of periods. He[26] too studied the Indian chronological tables and opined:

> *"Now, I find by my theory, that at the Indian epoch of 3102 years before CHRIST, the apparent and annual mean motion of Saturn was 12^0 13'14", and the Indian tables make it 12^0 13' 13".*

In like manner, I find, that the annual and apparent mean motion of Jupiter at that epoch was 30^0 20' 42'', precisely as in the Indian astronomy".

He is said to have felt struck with amazement at the idea of the days of Mercury (Wednesday), Jupiter (Thursday), Venus (Friday), Saturday (Saturn) and with the same names in India as in Northern Europe[27]. His quotation on the Indian numerals is too well to be repeated here.

Jean Sylvain Bailly (1774-1844):

In his ***Historie de l' Astronomie ancienne*** published in 1775, he announced that the Tiruvalore tables were probably 5000 or 6000 years old (p.114). He from a comparison of the tables of Tirvalore and Chrishnabouram, determined the epoch of the former to answer to midnight between the 17th and 18th of February of the year 3102 before Christ, at which time the sun was just entering the moveable zodiac, and was therefore in longitude of 10' 6^0. He tested the accuracy of the epoch as follows. The mean place of the sun was 10' 3^0 38' 13". As De La Grange demonstrated the perfection was less in former ages than the present and 1^0 45' 22" had to be added, so it came to 10' 2^0 51' 19", which is 19" more than the Tirvalore tables. Twelve years later he published a more detailed account, verifying the data in the tables and explaining why he believed that it could only have been obtained by actual observation and not by retrospective calculation[28]. Bentley in his book condemns him severely, because of his support for the Indian chronology.

Giovanni Cassini :

Reputed French astronomer. He published an account of "***Hindu Astronomy***" in 1691. He studied the Indian tables and announced that they were accurate and thus declaring that Hindus were having an established time recording. By analysing the Siamese tables, he dated them to the 21st March, in the year 638 of current era at 3 in the morning on the meridian of Siam (Mem.Acd.Scie. tom.8, p.312, Ast.Indienne, p.11). He asserted that the tables were neither derived from the Greeks nor Persians.

Jean Baptist Biot (1774-1862):

French physicist, who invented Polarimeter and famous for his researches on polarisation of light. But, he took enormous interest in Indian astronomy and chronology. When there was debate on India and China among the European scholars, he supported China to oppose India. He also dealt with the subject on *Surya Siddhanta*. Thus, interestingly, he was engaged in propagating that Indian asterism was derived from Chinese[29].

Erard Mollien:

He presented a paper before the Institute of France to prove the antiquity of the Indian Zodiac in 1853. He tried to demonstrate that India zodiac was datable to 3000

BCE. About the Kanya-Durga sitting on a lion dragging after it the solar car, he[30] described that –

> *"This is the reason why this Virgin Durga is not the simple memento of an astronomical fact, but verily the most ancient divinity of the Indian Olympus. She is evidently the same whose return was announced in all the Sibylline books – the source of the inspiration of Virgil – an epoch of universal motion....And why, since the months are still named after this Indian Zodiac, by the Malayalam speaking people (of southern India), should that people have abandoned it to take that of the Greeks? Everything proves, on the contrary, that these zodiacal figures were transmitted to the Greeks by the Chaldeans, who got them from the Brahmans".*

Almaq Riccoli:

He also studied the Indian tables compared with that of Alphonso, Copernicus, Tycho Brahe, Kepler etc., and opined[31]:

> *"The following is an answer to those men of science who might suspect that our astronomy was carried to India and communicated to the Hindus by our missionaries.*
>
> *1st.Hindu astronomy has its own peculiar forms, characterized by their originality; if it had been ur astronomy translated, great skill and knowledge would have been needed to disguise the theft.*
>
> *2nd.When adopting the mean movement of the moon, they would have adopted also the inclination of the ecleptic, the equation of the sun's centre, the length of the year; these elements differ completely from ours, and are remarkably accurate as applying to the epoch of 3102; while they would be exceedingly erroneous if they had been calculated for the last century.*
>
> *3rd. Finally, our missionaries could not have communicated to the Hindus in 1687 the tables of Cassini, which were not then in existence; they could have known only the mean motions of Tycho, Riccoli, Copernicus, Bouillaud, Kepler, Longomontanus, and thise of the tables of Alphonso. I will now give a tabular view of these mean motions for 4,383 years and 94 days:*

Table	Mean Motion				Difference from Hindu		
	D.	H.	M.	S.	H.	M.	S.
Alphonso	9	7	2	47	- 0	42	14
Copernicus	9	6	2	13	- 1	42	48
Tycho	9	7	54	40	+ 0	9	39
Kepler	9	6	57	35	- 0	47	26
Longomontanus	9	7	2	13	- 0	42	48
Bouillaud	9	6	48	8	- 0	58	53
Riccioli	9	6	53	57	+ 0	8	56
Cassini	9	7	44	11	+ 0	8	56
India	9	7	45	1	- 0	0	50

None of these mean motions, except Cassini's, agrees with that of Hindus, who therefore, did not borrow their mean motions, since their figures agree only with those of Cassini, whose tables were not in existence in 1687. This mean motion of the moon belongs, therefore, to the Hindus, who could only have obtained it by observation".

Albrecht Weber of Berlin (1825-1901):

In his lecture on Indian literature referred to Biot's researches and took occasion to express his want of faith in their chief result, the Chinese origin of the Hindu system of asterisms, and his suspicion that the Chinese might rather have derived their own system from India; inclining however toward the conclusion that this mode of division of heavens was first practised in Chaldea, and thence spread in both directions to India and to China[32]. In a later lecture, on the Intercourse between India and Western Countries, he repeated in still more peremptory manner his rejection of Biot's views[33].

John Bentley:

He was the main opponent of the Kali era as recorded in the astronomical tables taken from and researched by the European scientists. His only aim was evidently to disparage Indian chronology, just because, it had gone beyond the Mosaic Flood, as had been confessed by himself in his writings. He had obviously corresponded with Newton[33A], and other scientists to influence them to oppose the Indian chronology. Next to Colebrook, he attacked Bailly and John Playfair for his supporting lecture delivered on the astronomy of Indians and upholding the antiquity of it. Particularly, he was furious about his support for the Kali era. He even suspected that the unknown writer of the Edinburg Review, who had provided enough data to counter and challenge him might be John Playfair.

Henry Thomas Colebrook(1765-1837):

He was the founder of Indian philology and archaeology continuing the work of William Jones. He was the main supporter of Kali era, in joining hands with John Bentley. He had provided enough material to prove that the era was based on observations. The Edinburgh Review, Asiatic Researches, the Classical journal, the Asiatic Journal and other connected works elaborately contain the facts and debates of these scholars in detail[34].

Did Scientists used anti-Indian Baiting as a method to escape from the Inquisition or Church Punishment?

Incidentally, it can easily be noted that most of the scientists deal with here are connected with the Church controversies in the sense that their inventions one by one went on demolishing the Biblical beliefs - geocentric theory, Transubstantiation, Consubstantiation, Immaculate conception. Doctrine of Trinity, Resurrection, Ascension and so on. They had been subjected to the inquiries of Inquisition, imprisonment and punishment. Such incidences have been mentioned against each. Therefore, a doubt arises as to whether they had been compelled to oppose Indian chronology as a redemption from the inquisition or otherwise.

Sl. No	Scientist	His theory / law which was against biblical concepts	How he had been against Indians / Indian chronology
1	Sir Isaac Newton	Consubstantiation	The Chronology of the Ancient Kingdoms Amended
2	Joseph Priestley	His advanced political views affecting the interests of the Church	A Comparison of the Institutions of Moses with those of Hindoos
2	Galelio Galeli	Heliocentric theory. He was compelled to recant his belief in it, a century later, and he was thrown into prison for murmuring "*E pur si muove*" (And it still moves).	He was the opinion that Indians obtained astronomy from the Greeks.
3	Johannes Kepler	For supporting Heliocentric theory, the Church hounded him and he migrated to a Protestant country to escape persecution.	He accused that Hindus borrowed from the Jews and Christians.

These are the scientists, who might have tilted their views to favor Christrianity by opposing Hindus. Of course, there are other scientists, who have been suffered by inquisition by propounding new scientific theories and as well as supporting or reportedly influenced by Indians, e.g., Bruno. John Playfair, Cassini, Baily, Colebrook. Therefore, historians should be careful in dealing such biased conditions.

There is ample evidence available to prove the nexus between the scientists and the historians having allegiance to Church. The English and American historians had even engaged in a controversy as to whether or not there had been a direct connection between Protestantism (especially Puritanism) and the scientific (they profess to call it intellectual) revolution[34A], when much knowledge of science flew from India to Europe. They noted that in the early 16th and 17th centuries, the Catholic camp including Jesuits facilitated or, at least, did not obstruct progress in certain fields of science when it did not go against Christian interests[34B]. But 18th century changed the picture. As pointed out above, the scientific discoveries started questioning the chronology of the Bible. Thus, Newton was corresponding with Bentley about his discoveries, while fighting with Locke and Leibniz, the priest turned scientist Joseph Priestley rejecting Indian chronology, Kepler accusing Indians that they borrowed their calendar from Jews and Christians and so on..

How the Manuscripts, Charts, Tables Reached Europe?

Catalogues officially published by the different European Universities – Paris, London, Oxford, British Museum, India Office, Berlin, Leipzig, Vatican library give the list of thousands of manuscripts preserved there. Unofficially, the scientists, researchers and scholars might have been in possession of many manuscripts, as is evident from their

quoting in their works. That hundreds of German scholars were writing about and translating Indian works prove that they were in possession of such manuscripts, documents, charts and tables[35]. Robert W. Wink's note is also very relevant this context[36]:

> "*The most impressive orientalist explorations were collaborative, unofficial and voluntary. Among these, none matched the enormous privately funded venture by Colonel Colin Mackenzie. His teams of Maratha Brahman scholars begged, bought or borrowed, and copied, from village heads, virtually every manuscript of value they could finally acquired. Collections so acquired, reflecting the civilization of South India, manuscripts in every language, became a lasting legacy – something still being explored. Privately financed efforts by dedicated and enthusiastic gentry, European and Indian alike, multiplied. Collections of manuscripts in every part of India, such as those of C. P. Brown (Madras) and Walter Elliot (London), Saraswat Mahal (Thanjavur), Saiyidia Library (Madras and Hyderabad), Khuda Baksh (Patna), and Salar Jung (Hyderabad) and Iniyat Jung (Aligarh), proliferated. Work done by the Asiatic Society of Bengal and by the Madras Literary Society, reflected in their Journals, became a fashion. Neither the scorn of James Mill, not of Edward Said, has diminished the appeal of this tradition in India*".

That many scholars like Max Mueller were translating Sanskrit works into English even without seeing India proves that they were having thousands of manuscripts. However, the important charts, tables and documents taken away by the missionaries and others in the context is tabulated for ready reference. The list is only illustrative and not exhaustive.

Sl. No	Indian manuscripts taken away by	From where taken	When taken / period	Place, where they are available	The source / reference, which records
1	Roman Catholic missionaries	Different parts of India	15th to 19th centuries (thousands of palm-leaves, charts, tables etc.)	Vatican, Italy.	P. Palino A.. S. Bartholomaeo, *Historico-Criticum Codicum Indicorum*, Rome, 1792
2	M. la Loubere	Siam (belongs to 638 CE)	1687 (two sets of tables)	France	John Playfair, *Some Remarks on the Astronomy of Brahmins*, Edinburgh, 1789, p.4.
3	French Christian missionaries	India	Sent two sets of tables to Paris	Paris	Ibid, p.5. Gentil studied these tables later. Published in the Memoirs of the Academy of Sciences in 1772.
4	M. Le Gentil	India	1769	Paris	Gentil was there in India to observe the transit of Venus in 1769.
5	Fr. Du Champ, a Christian missionary	Chrisnabouram, a town in Carnatic (tables datable to 1491 CE)	1750 (15 tables)	The Academy of Sciences, Paris	Ibid, p.14. Studied by M. De L'Isle.
6	Fr. Du Champ, a Christian missionary	Chrisnabouram, a town in Carnatic	1751-53?	The Academy of Sciences, Paris	He brought other materials with precepts and examples from the Brahmins of Chrinabouram, and which were later translated into French.
7	Fr.Patouillet	Narasapour	Of the same period as that of Chrisnabouram c.1750	The Academy of Sciences, Paris	Received by M. De L'Isle, which contain rule to determine the length of the day.

8	Al-biruni	North Indian cities.	11th century	Ghazni	E.S. Kennedy, *A Commentary Upon Biruni's Kitab Tahid al Amakin, An 11th century Treatise on Mathematical Geography*, American University of Beirut, Beirut, 1973.
9	Robert de Nobili (1577-1656)	Madurai, Sri Rangam, Trichy, Tanjore, Salem and other cities.	17th century	Vatican, Rome, The Library of King of France.	V. Cronin, *A Pearl to India*, pp.176-182; J. L. Mirana, *The Introduction of Christianity into the Heart of India*, pp.22f. J. Hough, *A History of Christianity in India*, Vol II, pp.237-240 and Appendix C. J. Schmidlin, *Catholic Mission History*, USA, 1933, p.302
10	Matteo Ricci	Goa. Collected manuscripts were sent through him.	16th and 17th centuries.,	Vatican, Rome	
11	American Missionaries	Many medical, mathematical, astronomical, chemical Mss.		Harvard, Osler, McGill Universities, USA.	Introduction to Science during 14th century.
12	Colonel Colin Mackenzie	-do-		Ships loaded with privately acquired manuscripts were sent to London, but later reportedly returned to Madras.	Robert W. Winks (Ed)., *Historiography*, Vol.V of the Oxford History of the British Empire, 1999, USA, p.197.
13	Walter Elliot	-do-		London	-do-
14	C. P. Brown	-do-		Madras	-do-
15	H.T.Colebrooke	-do-	18th century	India office, London	A. A. Macdonell, *India's Past*, Motilal, 1956, p.247.

Conclusion:

The *French Revolution* in 1789 had activated the Scientific inventions and discoveries among the Europeans. Their contact with India had worked in two ways -

1. They came to know that the people of Orient had been also far better than that of the Occident. Thus, they tried to discover an intelligent group of people to be regarded as their forefathers and

2. The business activity turned political administration of India by the British had resulted in flowing of wealth into England during the material period triggering the so called *Industrial Revolution*. Enough money with sufficient scientific materials had made the Scientists to proceed further quickly.

First, they considered Indians as their forefathers and tried to create a model for them connecting with their other affiliations - Greek philosophy, art and architecture, Roman rule and culture, Judaic and Christian religions, White man's burden, etc. But, the could only find that the Indians were different from the Chaldeans, Assyrians, Egyptians, Greeks, Romans, Persians, Arabs, and others. The more they went deep into the subject, the more they found evidences against their "western" factors of culture, tradition, heritage, civilization. Thus, they not only started dis-associated with the corresponding Indian factors, but also started opposing them using counter-factors.

As more and more materials flow, new studies were conducted to get expected results. Already existing gadgets, implements and machines were reformed, improved and modernized for more production. For this, the techniques and models of India helped a lot. As they were the masters, they could not give full credit to Indians. However, the personal squabbling and disputes made the scientists to expose the truth behind it. That scientists too could have been influenced by the religion and religious institutions in inventions and discoveries with all their scientific enquiry, scientific temper, laboratory experiments and analytical inferences, it is quite reasonable how the historians could have succumbed to the Church and rulers in writing history, that too of India. In any case, the factual borrowings from India cannot be denied and the historians have to record them for posterity to understand the historical processes. Indian historiographical writings should be taken into account of these aspects in interpreting the Indian historical processes. As the attempts of the scientists incidentally connect with the chronology of Indian history, a multidisciplinary approach should be applied to this problem by bringing out more details from the respective countries.

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> "*I can venture to affirm, without meant to pluck a leaf from the never-fading laurels of our immortal Newton, that the whole of his theology, and part of his philosophy, may be found in the Vedas, and even in the works of Sufis*".

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2. Astronomical data and the Aryan question

2.2. ANCIENT HINDU ASTRONOMY

2.2.1. Astronomical tables

One of the earliest estimates of the date of the Vedas was at once among the most scientific. In 1790, the Scottish mathematician John Playfair demonstrated that the starting-date of the astronomical observations recorded in the tables still in use among Hindu astrologers (of which three copies had reached Europe between 1687 and 1787) had to be 4300 BC.[3] His proposal was dismissed as absurd by some, but it was not refuted by any scientist.

Playfair's judicious use of astronomy was countered by John Bentley with a Scriptural argument which we now must consider invalid. In 1825, Bentley objected: "By his [= *Playfair's*] attempt to uphold the antiquity of Hindu books against absolute facts, he thereby supports all those horrid abuses and impositions found in them, under the pretended sanction of antiquity. Nay, his aim goes still deeper, for by the same means he endeavours to overturn the Mosaic account, and sap the very foundation of our religion: for if we are to believe in the antiquity of Hindu books, as he would wish us, then the Mosaic account is all a fable, or a fiction."[4]

Bentley did not object to astronomy per se, in so far as it could be helpful in showing up the falsehood of Brahminical scriptures. However, it did precisely the reverse. Falsehood in this context could have meant that the Brahmins falsely claimed high antiquity for their texts by presenting as ancient astronomical observations recorded in Scripture what were in fact back-calculations from a much later age. But Playfair showed that this was impossible.

Back-calculation of planetary positions is a highly complex affair requiring knowledge of a number of physical laws, universal constants and actual measurements of densities, diameters and distances. Though Brahminical astronomy was remarkably sophisticated for its time, it could only back-calculate planetary position of the presumed Vedic age with an inaccuracy margin of at least several degrees of arc. With our modern knowledge, it is easy to determine what the actual positions were, and what the results of back-calculations with the Brahminical formulae would have been, e.g.: "Aldebaran was therefore 40' before the point of the vernal equinox, according to the Indian astronomy,